

Revision of the Genus *Pandanus* Stickman, Part 17 Species, Mostly New, in Borneo, Cambodia, and Vietnam

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IN BORNEO THERE ARE numerous known species of *Pandanus*, while in Cambodia there are but few. Several new ones from those regions are here proposed. Two new ones from Vietnam are also included, as are expanded descriptions and new locality records for certain species of Borneo and of Vietnam.

SPECIES FROM BORNEO

SECTION *Acrostigma*

Pandanus pumilus sp. nov. (sect. *Acrostigma*).

Fig. 206

DIAGNOSIS HOLOTYPE: Licet acaulescens, foliis 63–89 cm longis 7–8 mm latis subcoriaceis supra viridibus licet infra pallidioribus late sulcatis et cum plicis binis rotundatis inermibus, in sectione mediali cum 12–13 nervis secundariis parallelis in quoque latere, nervis tertiis nullis laminis gradatim in apice 15 cm longo trigono subulato diminuentibus eo 10 cm ex apice 3 mm lato, basi amplexicauli inermi purpurea excrassa et valde venosa, ex 4–4.5 cm marginibus cum aculeis 1–1.5 mm longis 1–5 mm separatis subulatis compressis subadscendentibus pallidis, midnervo infra ultra mediam inermi, in sectione mediali marginibus cum serrulis 0.3–0.5 mm longis 2–5 mm separatis adpressis, in apice subulato marginibus et midnervo infra cum serrulis 0.2–0.3 mm longis 0.5–3 mm separatis, ad apicem supra plicis cum serrulis 0.2–0.3 mm longis 4–5 mm separatis, inflorescentia foeminea erecta striata infra nuda parte $\frac{1}{3}$ infera retrorse scabra, bractea supera 12 cm longo parte $\frac{1}{4}$ infera 8 mm lata lanceolata foliacea parte $\frac{3}{4}$ supera trigona subulata, inflorescentia spicata cum 4–5 syncarpiis quaque

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sustenta cum bractea foliosa, ea mediali 2.3 cm longa 1 cm lata lanceolata, ultra mediam marginibus et midnervo infra cum serrulis, syncarpiis 1.5–2 cm longis 1.3–1.5 cm diametro elliptico-subglobozo cum 113–160 drupis, eis 6–7 mm longis 2.5–3.5 mm latis 1.5–3 mm crassis corpore oblanceo-ellipsoideo 5–6 mm longo stramineo valde striato, pileo cum basi 1 mm alto depresso pyramidali 5–6-anguloso luteo et cum vicinis connatis, stylo 1–1.5 mm alto parte basali lanceoloidea apice in angulo recto crasse subulato, stigmati 1–1.5 mm longo distali late lineari nigro papilloso paene in apice extento, endocarpio mediali ellipsoideo 3.8 mm longo cartilagineo stramineo lateribus 0.03 mm crassis, semine 3 mm longo ellipsoideo, mesocarpio apicali minuto, mesocarpio basali 1 mm longo in lateribus fibroso in media carnoso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Apparently acaulescent, or perhaps with short slender stems; leaves 63–89 cm long, 7–8 mm wide, thin coriaceous, green above, apparently slightly paler beneath, broad-furrowed above the midrib and with two rounded pleats, above unarmed, at midsection with 12 or 13 parallel secondary veins in each half, no visible tertiary cross veins, very gradually narrowed to a trigonous subulate apex 15 cm long, this 10 cm down 3 mm wide, the base amplexicaul, unarmed, purple, thin and strongly veiny, beginning 4–4.5 cm from the base the margins with prickles 1–1.5 mm long, 1–5 mm apart, flattened subulate, slightly ascending, pale; the midrib unarmed to beyond the middle; at midsection the margins with appressed serrulations 0.3–0.5 mm long, 2–5 mm apart; on the subulate apex the margins and midrib below with serrulations 0.2–0.3 mm long, 0.5–3 mm apart; towards the apex on the upper side the pleats with serrulations 0.2–0.3 mm long, 4–5 mm apart; pistillate inflorescence erect, striate, naked except

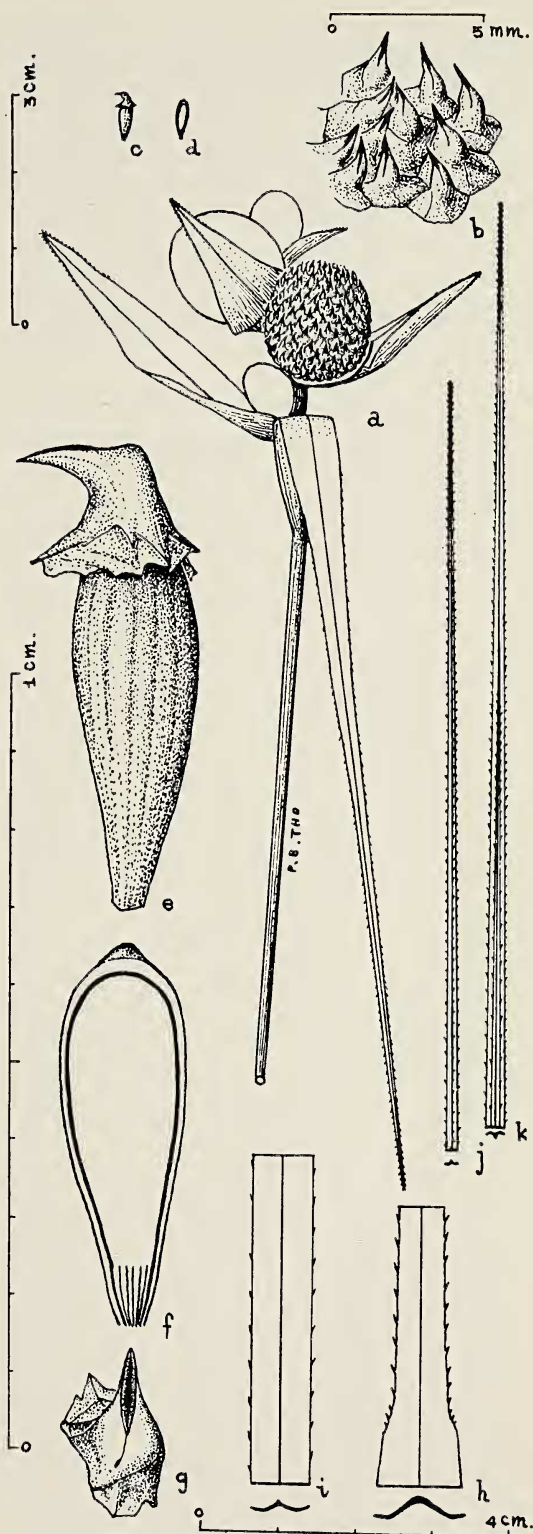
at apex, the lower $\frac{1}{3}$ retrorse scabrous; apical sterile bract 12 cm long, its lower quarter 8 mm wide, lanceolate, foliaceous, the remainder trigonous subulate; inflorescence spicate, with 4 or 5 syncarps, each subtended by a leafy, apparently green, bract, the median one 2.3 cm long, 1 cm wide, lanceolate, beyond the middle the margins and midrib below serrulate; syncarps 1.5–2 cm long, 1.3–1.5 cm in diameter, elliptic-subglobose, bearing about 113–160 drupes, these 6–7 mm long, 2.5–3.5 mm wide, 1.5–3 mm thick, the body oblance-ellipsoid, 5–6 mm long, stramineous, heavily striate; pileus with the base 1 mm high, low pyramidal, 5–6-angled, at maturity yellow and the adjacent ones connate; style 1–1.5 mm high, this basal portion lanceoloid, bearing proximally at right angles the stout subulate tip; stigma 1–1.5 mm long, distal, broad linear, black, papillose, reaching almost to the tip; endocarp median, ellipsoid, 3.8 mm long, cartilaginous, stramineous, the walls 0.03 mm thick; seed 3 mm long, ellipsoid; apical mesocarp minute; basal mesocarp 1 mm long, fibrous up the walls, fleshy within.

HOLOTYPE: Sarawak, Gunong Pueh, rocks in forest, epiphyte, 3,000 ft. alt., 25 Aug. 1955, *J. W. Purseglove* 4,799 (SING).

SPECIMENS EXAMINED: Sarawak, Nanga Pelagos, Buah Kuning, 24 July 1938, *Daud & Tachun* 35,645 (SING).

DISCUSSION: *Pandanus pumilus* is a member of the section *Acrostigma*, as is its closest relative, *P. fruticosus* St. John of North Borneo, a species which has the syncarp solitary, 3 cm long, 2 cm in diameter, ellipsoid; drupes 9–10 mm long; style arcuate ascending; and the leaves 51–58 cm long, 8–10 mm wide, and the marginal serrations black. *P. pumilus* St. John of Sarawak has the syncarps 4 or 5 in a spike and 1.5–2 cm long, 1.3–1.5 cm in diameter, elliptic-

FIG. 206. *Pandanus pumilus* St. John, from holotype. *a*, Inflorescence, $\times 1$; *b*, carpel apices and stigmas, oblique distal view, $\times 4$; *c*, drupe, lateral view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e*, drupe, lateral view, $\times 10$; *f*, drupe, longitudinal median section, $\times 10$; *g*, drupe apex and stigma, apical view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$; *k*, leaf apex, upper side, $\times 1$.



subglobose; drupes 6–7 mm long; style proximally bent at right angles; and the leaves 63–89 cm long, 7–8 mm wide, and the marginal serrations pale.

The new epithet is the Latin adjective *pumilus*, small, and is given in reference to the tiny syncarps and drupes.

SECTION *Microstigma*

Pandanus trigonus sp. nov. (sect. *Microstigma*)
Fig. 207

DIAGNOSIS HOLOTYPE: Foliis 2.5 m longis 11 cm latis crassiter coriaceis 1-sulcatis 2-plicatis in sectione mediali cum 55 nervis secundariis parallelis inconspicuis in quoque latere, nervis tertiis obliquis et reticulis breviter rhombicis formantibus, laminis ligulatis longe in apice 35 cm longo subulato trigono diminuentibus eo 10 cm ex apice 3.5 mm lato, proxima basem marginibus cum spinis 2.5–3.5 mm longis 4–10 mm separatis crassiter arcuato-deltoides adscendentibus pallidis, midnervo infra cum spinis 2–3 mm longis 10–20 mm separatis simulantibus infimis reflexis alteris adscendentibus in sectione mediali marginibus cum spinis 2–2.2 mm longis 8–17 mm separatis deltoides compressis salientibus apicibus rubris, midnervo infra cum serris 1.5 mm longis 9–20 mm separatis, in apice subulato marginibus et midnervo infra cum serris 1–1.5 mm longis 6–15 mm separatis crassis, pedunculo foemineo 2 cm diametro trigono, syncarpio licet solitario 26 cm longo 4.5 cm diametro subcylindrico sed parve supra diminuentibus et proxima apicem 3 cm diametro 3-laterato cum circa 1,776 drupis, eis 9–10 mm longis 1.7–2.5 mm latis et crassis distinctis anguste oblanceo-ellipsoideis parte $\frac{1}{3}$ supra libera, corpore 7–8 mm longo anguste ellipsoideo, pileo 4–5 mm longo laevi dimidia infera oblonga dimidia supra rotundato-pyramidalis apice oblongo-pentagonali truncato, stigmatibus sessilibus 0.9–1.3 mm diametro orbiculari vel orbiculari-cordato sessilibus exelevato brunneo apicem obtecto, endocarpio mediali cartilagineo lateribus brunneis 0.1 mm crassis, semine 5.5 mm longo ellipsoideo, mesocarpio apicali 1.5 mm longo fibroso et medullosa, mesocarpio basali parvo fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Leaf 2.5 m long, 11 cm wide, thick coriaceous, 1-ribbed, 2-pleated, at midsection with 55 parallel secondary veins in each half, these inconspicuous, the tertiary cross veins oblique, forming short rhombic meshes, the blade ligulate, long tapering to a 35 cm subulate, trigonous apex which about 10 cm down is 3.5 mm wide, near the base the margins with spines 2.5–3.5 mm long, 4–10 mm apart, thick arcuate deltoid, ascending, pale, the midrib below with similar spines 2–3 mm long, 10–20 mm apart, the lowest reflexed, the others ascending; at midsection the margins with spines 2–2.2 mm long, 8–17 mm apart, deltoid, flattened, salient, red-tipped; the midrib below with serrations 1.5 mm long, 9–20 mm apart; along the subulate apex the margins and the midrib below with heavy serrae 1–1.5 mm long, 6–15 mm apart; pistillate peduncle 2 cm in diameter, trigonous; syncarp probably single, 20–26 cm long, 4.5 cm in diameter, subcylindric but gently tapering upwards and near the tip 3 cm in diameter, 3-sided, bearing about 1,776 drupes, these distinct, 9–10 mm long, 1.7–2.5 mm wide and thick, narrowly oblance-ellipsoid, upper $\frac{1}{3}$ free, the body 7–8 mm long, narrowly ellipsoid; pileus 4–5 mm long, smooth, the lower half oblong, the upper half rounded pyramidal to the oblong pentagonal truncate apex; stigma sessile, 0.9–1.3 mm in diameter, orbicular to orbicular-cordate, sessile, flush, brown, covering the apex; endocarp median, cartilaginous, the walls brownish, 0.1 mm thick; seed 5.5 mm long, ellipsoid; apical mesocarp 1.5 mm long, fibrous and pithy; basal mesocarp sparse, fibrous and fleshy.

HOLOTYPE: Sarawak, Bau, H. N. Ridley (SING).

SPECIMENS EXAMINED: British North Borneo, Tawao, Elphinstone Prov., Oct. 1922 to March 1923, A. D. E. Elmer 21,022 (C, M, SING).

DISCUSSION: *P. trigonus* is a member of the section *Microstigma*, as is its closest relative, *P. subumbellatus* Solms of northeast New Guinea, a species with the syncarp 20 cm long, 8–10 cm in diameter, surrounded by long spathes; drupes 12–15 mm long, 3 mm wide; stigmas 1–5 mm wide; and the leaves 6 cm wide. *P. trigonus* St.

John has the syncarp 20–26 cm long, 4.5 cm in diameter; drupes 9–10 mm long, 1.7–2.5 mm wide; stigmas 0.9–1.3 mm wide; and the leaves 11 cm wide.

The new epithet is the Latin adjective *trigonus*, three-angled, and is given in reference to the three-angled syncarp.

SECTION *Pandanus*

Pandanus tectorius Soland. var. *borneensis* Martelli, *Webbia* 4(2):410, pl. 19, fig. 6, 1914

Fig. 208

EXPANDED DESCRIPTION: From Wood & Wyatt-Smith A4,567: Shrub, 8.6 m tall; branch apex 3.5 cm in diameter; leaves 84–100 cm long, 4 cm wide, coriaceous, broad furrowed above the midrib, the sides arched and recurving, at midsection with 46 parallel secondary veins in each half, but no visible tertiary veins, blade sword-shaped, tapering gradually to the trigonous, broad subulate apex, this 10 cm down 10 mm wide, the base amplexicaul, unarmed, but beginning 8 cm up the margins with prickles 2–3.5 mm long, 7–13 mm apart, arcuate subulate, ascending, pale; the midrib below beginning at 7–10 cm with prickles 3–3.5 mm long, 17–32 mm apart, heavy subulate, arcuate, reflexed; at midsection the margins with prickles 2–4 mm long, 12–20 mm apart, similar, ascending; the midrib below with prickles 2.5–3.2 mm long, 35–39 mm apart, similar; on the subulate apex the margins with serrulations 0.2–0.3 mm long, 2–4 mm apart; the midrib below with similar serrulations but 3–6 mm apart; phalanges 5.3–5.8 cm long, 2.9–3.5 cm wide, 2.5–2.9 cm thick, pyriform, 4–5-angled, the sides gently convex, smooth, shining, when dried light brown, upper $\frac{1}{2}$ free, the apex convex, lateral sutures none, central apical sinuses 1–2 mm deep, very shallow but the bottom half V-shaped; carpels 6 or 7, the apices low obtuse and the marginal ones with a small concavity distal of the stigma, the outer carpels $1\frac{1}{2}$ –2 times the larger; stigma 3–3.5 mm long, elliptic, creased, dark brown, elevated; proximal sinus a wide crack running $\frac{1}{3}$ – $\frac{1}{2}$ way to valley bottom; endocarp slightly supramedian, 22 mm long, bony, the inner parts dark mahogany

colored, the outer parts pale, the lateral walls 4–5 mm thick, the inner surfaces shining; seeds 14–16 mm long, 3–4 mm in diameter, ellipsoid or obliquely so; upper mesocarp forming in each carpel apex a cavity with brownish medullary membranes; basal mesocarp fibrous and fleshy.

SPECIMENS EXAMINED: North Borneo, Sipitang District, Sibubu River, Mengalong Forest Reserve, 5 miles s. w. of Sipitang, 5 ft. alt., 30 July 1954, G. H. S. Wood & J. Wyatt-Smith A4,567 (SING).

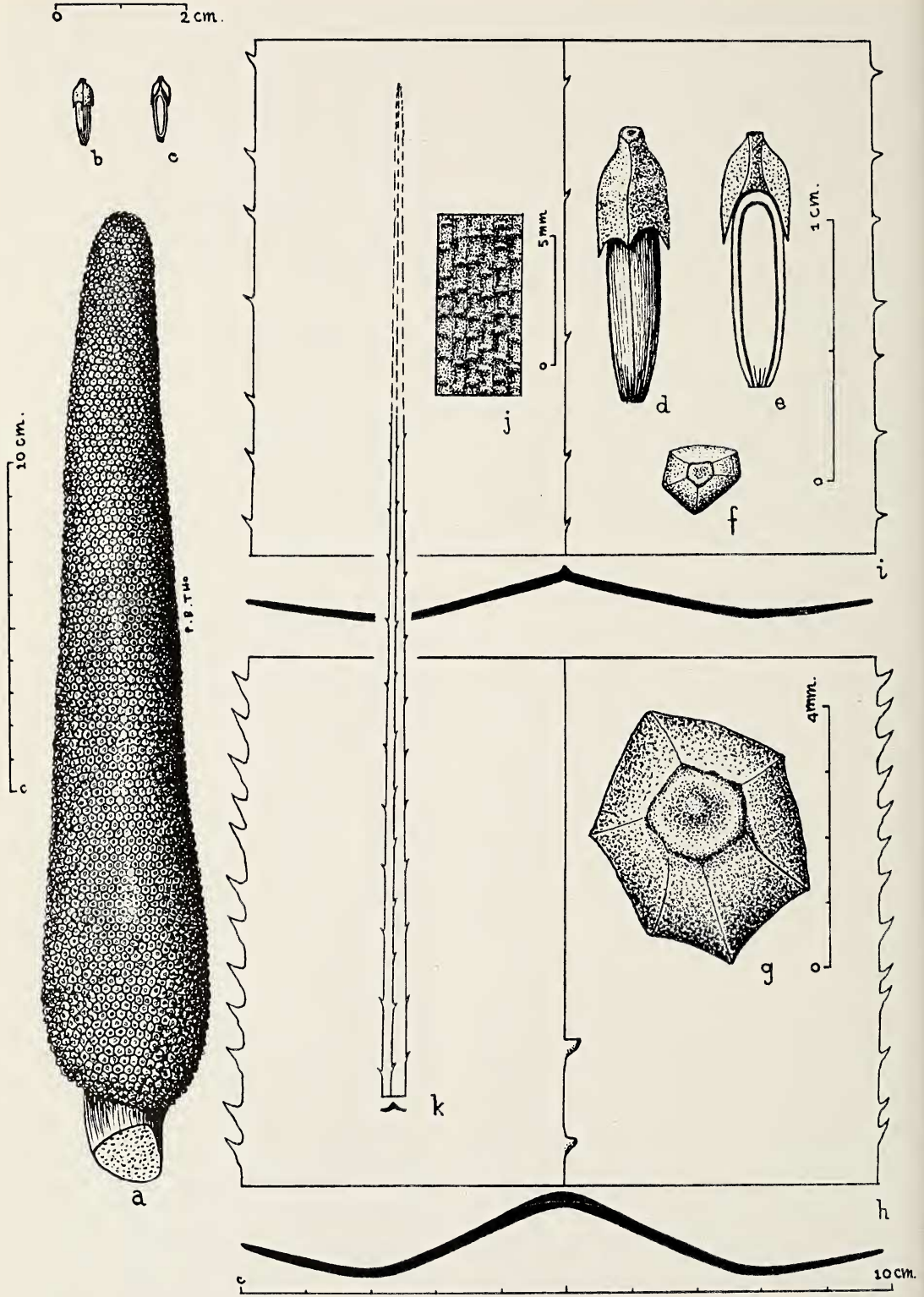
SPECIES FROM CAMBODIA

SECTION *Acrostigma*

Pandanus pendens sp. nov. (sect. *Acrostigma*)
Figs. 209, 213a, b

NOM. VERN.: "rhom cheak."

DIAGNOSIS HOLOTYPEI: Frutex 7–8 m alta 4 cm diametro erecta multi-ramosa, cortice brunneo et cum spinis 7–10 mm longis anguste conicis, radicibus futurosus 20–40 cm longis 1 cm diametro spinosis paucis, foliis 85–92 cm longis 2.8–3 cm latis supra obscure viridibus infra pallidis et glaucis ligulatis coriaceis in sectione mediali cum 28 nervis secundariis in quoque dimidio gradatim ex basi in apice subulato diminuentibus eo 10 cm ex apice 3 mm lato, basi amplexicauli et inermi sed ex 4.5–5 cm marginibus cum dentibus 1.5–2 mm longis 3–8 mm separatis subulato-serratis, midnervo infra ad mediam inermi, in sectione mediali marginibus cum serris 0.7–1 mm longis 4–6 mm separatis adpressis, proxima apicem marginibus et midnervo infra cum serrulis 0.2–0.3 mm longis 2–4 mm separatis, pedunculo 20–35 cm longo 10–12 mm diametro obtuse trigono folioso-bracteato sed bracteis deciduis, syncarpio solitario terminali pendenti 7–10 cm longo 6–8 cm diametro latiter ellipsoideo, drupis numerosissimis 27–32 mm longis 2.5–3 mm latis 1.5–2 mm crassis sublinearibus 4–6-angulosis parte $\frac{1}{4}$ supera libera, pileo laevi anguste ovoideo-conico sed aliquis obliquis et proxime inclinatis deciduis, stylo 2.5–3 mm longo subulato proxime arcuato cartilagineo, stigmatate 2–2.5 mm longo distali sublineari brunneo exlaevi, endocarpio in parte $\frac{2}{5}$ infera cartilagineo brunneo lateribus 0.1 mm crassis, semine 6–7 mm longo ellipsoi-



deo, mesocarpio apicali viridi mucilaginoso sed in sicco cavernoso et 12 mm longo, mesocarpio basali in lateribus fibroso sed intra carnosio.

DIAGNOSIS OF HOLOTYPE: Shrub, 7–8 m tall, 4 cm in diameter, erect, freely branched above; bark brown, with sharp, narrow, conic spines 7–10 mm long; prop roots few, 20–40 cm long, 1 cm in diameter, spiny; leaves 85–92 cm long, 2.8–3 cm wide, dark green above, pale and glaucous below, ligulate, coriaceous, at midsection with 28 parallel secondary veins in each half, gradually tapering from the base to the subulate apex, this 10 cm down 3 mm wide, the very base cuneate widened, amplexicaul, unarmed, but beginning 4.5–5 cm up the margins with teeth 1.5–2 mm long, 3–8 mm apart, subulate-serrate; midrib unarmed as far as the middle; at midsection the margins with appressed serrae 0.7–1 mm long, 4–6 mm apart; near the tip the margins and the midrib below with serrations 0.2–0.3 mm long, 2–4 mm apart; peduncles 20–35 cm long, 10–12 mm in diameter, obtusely trigonous, leafy bracted but the bracts deciduous before the fruit matures; syncarp single, terminal, pendent, said to become "20 cm. long and yellow," but those seen nearly mature (with well-formed seeds) 7–10 cm long, 6–8 cm in diameter, broad ellipsoid; drupes very numerous, 27–32 mm long, 2.5–3 mm wide, 1.5–2 mm thick, almost linear, 4–6-angled, upper $\frac{1}{4}$ free; pileus smooth, narrowly ovoid-conic, but somewhat oblique and inclined proximally, deciduous; style 2.5–3 mm long, subulate, proximally arcuate, cartilaginous; stigma distal, 2–2.5 mm long, almost linear, brown, rough; endocarp in lower $\frac{2}{3}$, cartilaginous, brown, the walls 0.1 mm thick; seed 6–7 mm long, ellipsoid; apical mesocarp continuous, green, mucilaginous but on drying shrinking to form a cavity 12 mm long; basal mesocarp fibrous along periphery, fleshy within.

HOLOTYPE: Cambodia, 1 km. s. of Ph. Khdat, $\frac{1}{2}$ km. inland, 16 km. w. of Kampot, in narrow, wooded stream gulch some 10 m. deep,

15 m. alt., May 19, 1960, *Harold St. John* 26,344 (BISH).

DISCUSSION: *P. pendens* is a member of the section *Acrostigma*, as is its closest relative, *P. pectinatus* Martelli of Sarawak, a species with the drupes 27 mm long, 3–4 mm wide, linear oblong; endocarp in lower $\frac{1}{3}$, enclosing a conic cavity half as long and just above the seed cavity. *P. pendens* St. John of Cambodia has the drupes 27–32 mm long, 2.5–3 mm wide, cuneate; endocarp in lower $\frac{2}{3}$, not enclosing a superior cavity.

Local inhabitants reported that the leaves are used for plaiting mats, and that after drying they are boiled to make a medicine for fevers of children.

The new epithet is the Latin participle *pendens*, hanging, given in reference to the posture of the fruit.

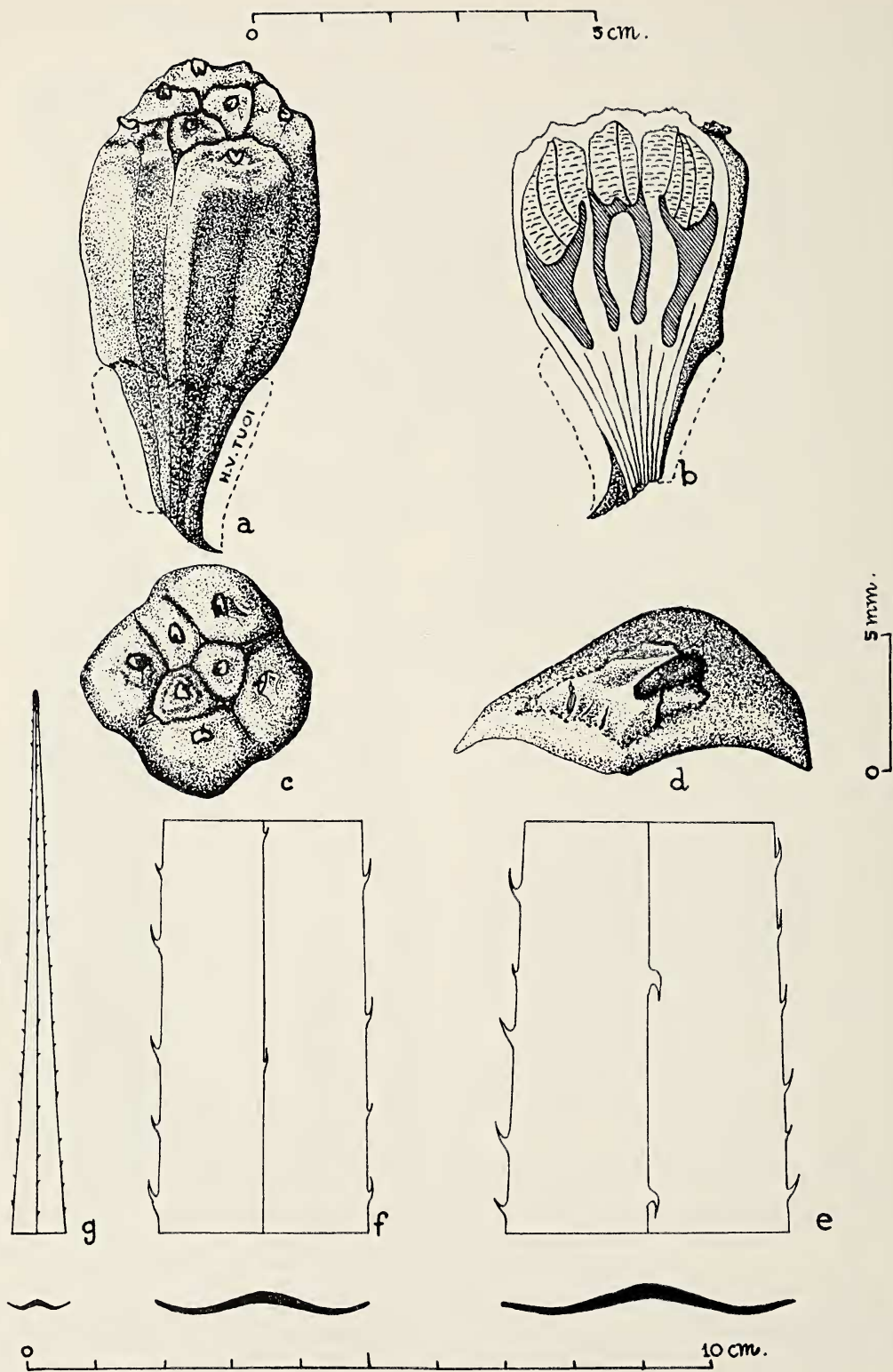
SECTION *Rykia*

Pandanus cupribasalis sp. nov. (sect. *Rykia*)
Figs. 210, 213c, d

NOM. VERN.: "rhom cheak."

DIAGNOSIS HOLOTYPI: Frutex 2–4 m alta 3–5 cm diametro cum ramis erectis pluribus plerumque simplicibus, cortice brunneo laevi vel cum radicillis spinosis paucis, radicibus ful-turosus 30–60 cm longis 1 cm diametro sub-laevibus sed cum radicillis conicis paucis remotis, foliis multis 1.48 m longis 3.8–4 cm latis supra obscure viridibus infra viridibus late sulcatis et subplicatis ligulatis sed in 20 cm ultimis in apice trigono subulato abrupte diminuentibus eo in puncto 10 cm ex apice 1.6 mm lato, in sectione mediali cum 31–34 nervis secundariis parallelis in quoque latere et ad apicem infra cum nervis tertiis transversis evidentis et reticulis anguste oblongis formantibus, basi amplexicauli inermi intense cupracea et ex 15–25 cm marginibus cum spinis 4–5 mm longis 12–18 mm separatis crassiter subulatis arcuatis adscendentibus pallidis excepta apicibus

FIG. 207. *Pandanus trigonus* St. John, from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, apical view, $\times 4$; *g*, drupe, apical view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, secondary and tertiary veins, lower side, at middle, $\times 4$; *k*, leaf apex, lower side, $\times 1$.



brunneis, midnervo infra ex 25 cm cum aculeis 5–7 mm longis 18–22 mm separatis crassiter subulatis reflexis, in sectione mediali marginibus cum aculeis 1.8–2 mm longis 10–25 mm separatis subulatis adpressis adscendentibus, midnervo infra subinermi, proxima apicem marginibus et midnervo infra cum serrulis 0.3–0.6 mm longis 2–6 mm separatis, pedunculo 50 cm longo in apice 13 mm diametro infra graciliori folioso-braceato cernuo terminali, syncarpio unico 16.5 cm longo 8 cm diametro oblongo-ellipsoideo 3-laterato cum circa 540 drupis et superficie spinoso ex stylis salientibus, drupis 25–30 mm longis 7–10 mm latis 5–9 mm crassis cuneato-oblancoideis viridibus sed apparente lutescentibus laevibus 6-lateratis lateribus planis parte $\frac{1}{4}$ supera libera, pileo pyramidali-semiorbiculari, stylo 3–4 mm longo valido osseoso crasso lucido corniformi brunneo in 40° adscendenti latiter bifido (rare trifido, et eis apicalibus simplicibus), stigmatibus 3 mm longo plerumque latiter ovato et in apice bifido brunneo papilloso, endocarpio minime submediali aurantiaco-brunneo lateribus 2 mm crassis, semine 8–9 mm longo 3 mm diametro anguste ellipsoideo; mesocarpio apicali cavernoso et cum fibris longitudinalibus paucis et membranis medullosis, mesocarpio basali fibroso et carnosio.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Shrub 2–4 m tall, 3–5 cm in diameter, with several erect, mostly simple stems; bark brown, smooth, or with a few latent rootlets; prop roots few, 30–60 cm long, 1 cm in diameter, smooth, except for a few remote conic rootlets; leaves in terminal plumes, numerous, 1.48–3.6 m long, 3.8–4 cm wide, above dark green, below green, with a broad central groove and gently down curved outer quarters, ligulate, then about 20 cm from the tip abruptly narrowed into a subulate trigonous tip which 10 cm down is 1.6 mm wide, at midsection with 31–34 parallel secondary veins in each half, towards the apex the lower side with evident tertiary cross veins making a reticulum of narrow oblong meshes, the amplexicaul, hidden base unarmed, bright

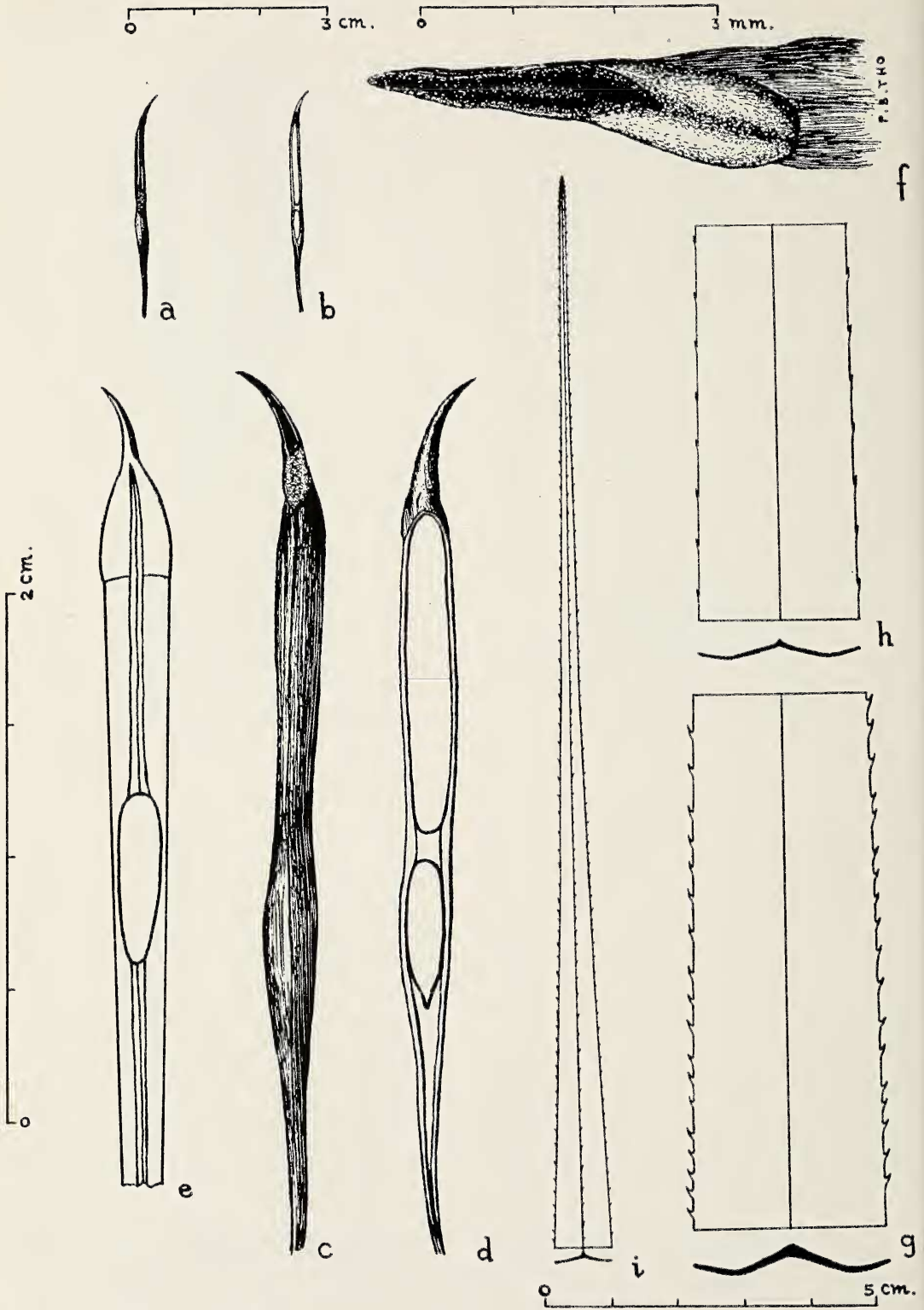
copper-orange, beginning at 15–25 cm up the margins with spines 4–5 mm long, 12–18 mm apart, heavy subulate, arcuate, ascending, pale, but the tip brownish; the midrib below, beginning 15–25 cm from the base with stout subulate spines 5–7 mm long, 18–22 mm apart, reflexed; at midsection the margins with prickles 1.8–2 mm long, 10–25 mm apart, subulate, appressed ascending, the nearby midrib below almost unarmed; near the apex the margins and midrib below with serrulations 0.3–0.6 mm long, 2–6 mm apart; peduncle 50 cm long, at apex 13 mm in diameter, tapering and more slender downwards, leafy bracted, nodding, terminal; syncarp single, 16.5 cm long, 8 cm in diameter, oblong-ellipsoid, distinctly 3-sided, with about 540 drupes, the surface thorny from the projecting styles; drupes 25–30 mm long, 7–10 mm wide, 5–9 mm thick, cuneate-oblancooid, still green, apparently becoming yellowish, the surface smooth, 6-sided, the sides plane, upper $\frac{1}{4}$ free; pileus pyramidal-semiorbicular; stylar beak 3–4 mm long, stout, bony, shining, brownish, ascending at about 40° , almost all widely bifid, but rarely one is trifid, and the apical ones 1-dentate; stigma 3 mm long, mostly broad ovate and bifid at apex, brown, papillose; endocarp slightly submedian, orange-brown, the lateral walls 2 mm thick; seed cavity 8–9 mm long, 3 mm in diameter, narrowly ellipsoid, traversed by longitudinal fibers; apical mesocarp cavernous, with a few longitudinal fibers and medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Cambodia, Chaine de l'Elephant, on the mountain grade 12 km. below Le Bokor, dense moist fern forest, with *Ficus*, *Homalanthus*, and *Hicriopteris*, 1,000 m. alt., May 20, 1960, *H. St. John* 26,346 (BISH).

SPECIMENS EXAMINED: Cambodia, Bokor, common in ever green forest, 900 m. alt., 21 Feb. 1960, *Tem Smitinand* 6,534 (BKF).

DISCUSSION: *P. cupribasalis* is a member of the section *Rykia*, as is its closest relative, *P. furcatellus* Martelli, of Indochina, a species with

FIG. 208. *Pandanus tectorius* Soland. ex Warb. var. *borneensis* Martelli, from Wood & Wyatt-Smith A4,567. a, Phalange, lateral view, $\times 1$; b, phalange, longitudinal median section, $\times 1$; c, phalange, apical view, $\times 1$; d, carpel apex and stigma, oblique view, $\times 4$; e, leaf base, lower side, $\times 1$; f, leaf middle, lower side, $\times 1$; g, leaf apex, lower side, $\times 1$.



the syncarp covered with bracts, solitary, erect; styles ovate, acute; endocarp 1.5 cm long, the lateral walls 0.8 mm thick; seed cavity truncate at apex, 6 mm in diameter; leaves 8 cm wide, near the base the margins with spines 6 mm long, 14–23 mm apart, stout arcuate subulate, the tips brownish, on the midrib below the spines 7–8 mm long, 22–40 mm apart, similar but reflexed and the tips slender. *P. cupribasalis* has the syncarp exposed, solitary, nodding; styles lanceolate, acute; endocarp 2 cm long, the lateral walls 2 mm thick; seed cavity ellipsoid, 4 mm in diameter; leaves 3.8–4 cm wide, near the base the margins with spines 4–5 mm long, 12–18 mm apart, those of the nearby midrib below 5–7 mm long, gradually narrowed to a long subulate apex.

The new epithet is formed from the Latin *cuprum*, copper; *basalis*, of the base, and is given in allusion to the strikingly copper-colored leaf bases.

SPECIES FROM VIETNAM

SECTION *Rykia*

Pandanus depressus sp. nov. (sect. *Rykia*)

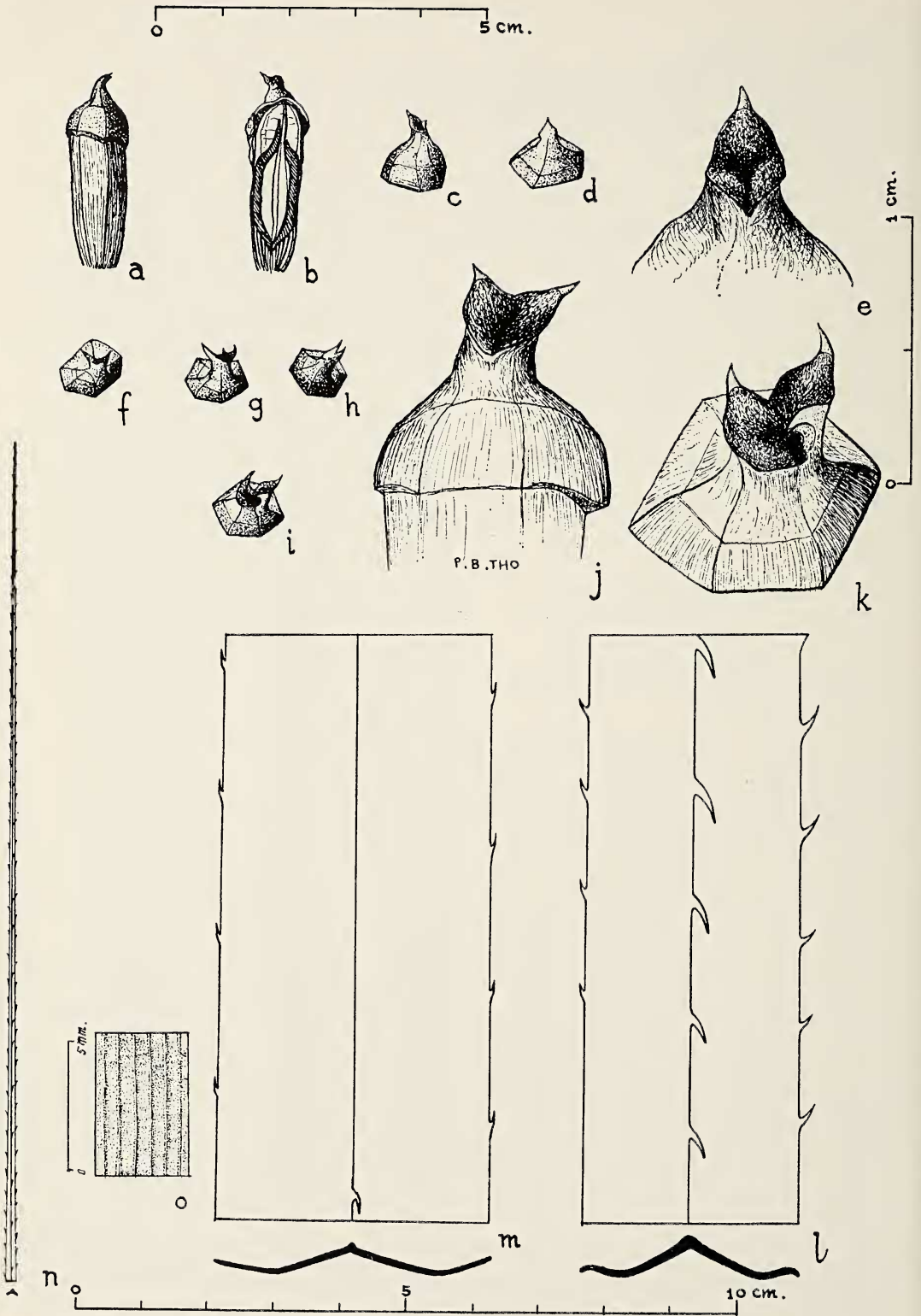
Figs. 211, 214a

DIAGNOSIS HOLOTYPEI: Caulibus foliisque non conservatis (collector dicit ad *P. horizontalis* simulantibus, id est caule 1.5 m alto 4–5 cm diametro cum radicillis adpresse adscendentibus paucis, foliis 2.72 m longis 3.8 cm latis olivaceis 2-plicatis ligulatis abrupte in apice subulato caudato contractis, marginibus et midnervo infra cum aculeis validis), inflorescentia foeminea terminali cum syncarpio solitario, pedunculo 17 cm vel ultra longo 12 mm diametro 3-laterato folioso-bracteato, syncarpio 15 cm longo 8 cm diametro cylindrico cum apicibus rotundatis et cum circa 816 drupis submaturis viridibus, drupis in lineis subverticalibus eis basalibus et apicalibus minime latioribus, drupis 30–32 mm longis 8–12 mm latis 6–10 mm crassis anguste cuneatis 6-angulis parte $\frac{1}{6}$ supera libera cor-

pore 26–28 mm longo, pileo cum basi 5–6 mm alto valde depresso rotundato-pyramidali laevi glauco, stylo terminali validi corniformi subrecto vel minime proxime curvato eis apicalibus valde curvato 1.5–2 mm alto furcis 2–3 mm longis horizontali-divergentibus osseosis acutis paucis cum lobis lateralibus binis proximalibus, stigmatibus 1.5–2.5 mm longis lanceolatis brunneis papillosis non ad apices extentis semiproximalibus et terminalibus, endocarpio submediali osseoso brunneo et cum apice mediali acuminato lateribus 1 mm crassis, semine 8–9 mm longo 4 mm diametro obovoideo, mesocarpio apicali medullosa molli albo exfibroso, mesocarpio basali in lateribus fibroso in centro carnoso.

DIAGNOSIS OF HOLOTYPE: Stem and leaves not collected (but said by the collector to be similar to his no. 2,519, *P. horizontalis*; that is, stem 1.5 m tall, 4–5 cm in diameter, with a few appressed ascending rootlets; leaves 2.72 m long, 3.8 cm wide, olive green, 2-pleated, ligulate, abruptly contracted to a caudate, subulate apex, the margins and midrib below with stout prickles); pistillate inflorescence terminal, bearing one syncarp; peduncle more than 17 cm long, 12 mm in diameter, 3-sided, leafy bracted; syncarp 15 cm long, 8 cm in diameter, cylindrical with rounded ends, bearing about 816 drupes, somewhat immature, green, but with hard endocarp and well-formed seeds, probably nearly full size; drupes arranged in nearly vertical rows, the basal and apical drupes slightly broader, but not significantly so; drupes 30–32 mm long, 8–12 mm wide, 6–10 mm thick, narrowly wedge-shaped, 6-angled, upper $\frac{1}{6}$ free, the body 26–28 mm long; pileus with its base 5–6 mm high, much depressed, rounded pyramidal, smooth, glaucous; style terminal, stout, hornlike, suberect or slightly curved proximally, the apical ones definitely so, 1.5–2 mm high, the two forks lanceolate, 2–3 mm long, spreading horizontally, hard, sharp, mucronate and unpleasant to handle, sometimes with 2 small proximal lateral lobes; stigmas 1.5–2.5 mm long, lanceolate, brown, papillose, not reaching to the tip, semiproximal

FIG. 209. *Pandanus pendens* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, drupe, lateral view, $\times 4$; *d*, *e*, drupe, longitudinal median section, $\times 4$; *f*, carpel apex and stigma, distal view, $\times 15$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.



and terminal; endocarp submedian, bony, brown, with an apical subulate prolongation, the walls 1 mm thick; seed 8–9 mm long, 4 mm in diameter, obovoid; apical mesocarp soft white, pithy, without fibers; basal mesocarp fibrous up the periphery, fleshy within.

HOLOTYPE: Vietnam, Hon Tho'm, île S. de Phu qu'ôc, bord de ruisseau, 30–50 m. de rivage, à l'ombre des arbres, 7 janvier 1961, *Pham Hoang Ho 2,530* (BISH).

DISCUSSION: *P. depressus* is a member of the section *Rykia*, as is its closest relative, *P. horizontalis* St. John, a species from the same island, but with syncarp broadly ellipsoid, 10.5 cm long; terminal and subterminal drupes the larger; pileus base conic; styles often with 2–4 secondary lobes; stigmas terminal; endocarp in lower $\frac{1}{3}$, the walls 0.1 mm thick; seed 2.5 mm in diameter. *P. depressus* has the syncarp cylindrical, 15 cm long; drupes all about the same size; pileus base much depressed rounded pyramidal; styles sometimes with 2 secondary lobes; stigmas semiproximal and terminal; endocarp submedian, the walls 1 mm thick; and the seed 4 mm in diameter.

The new epithet is the Latin adjective *depressus*, depressed, and is given in reference to the depressed rounded pyramidal pileus base.

Pandanus horizontalis sp. nov. (sect. *Rykia*)

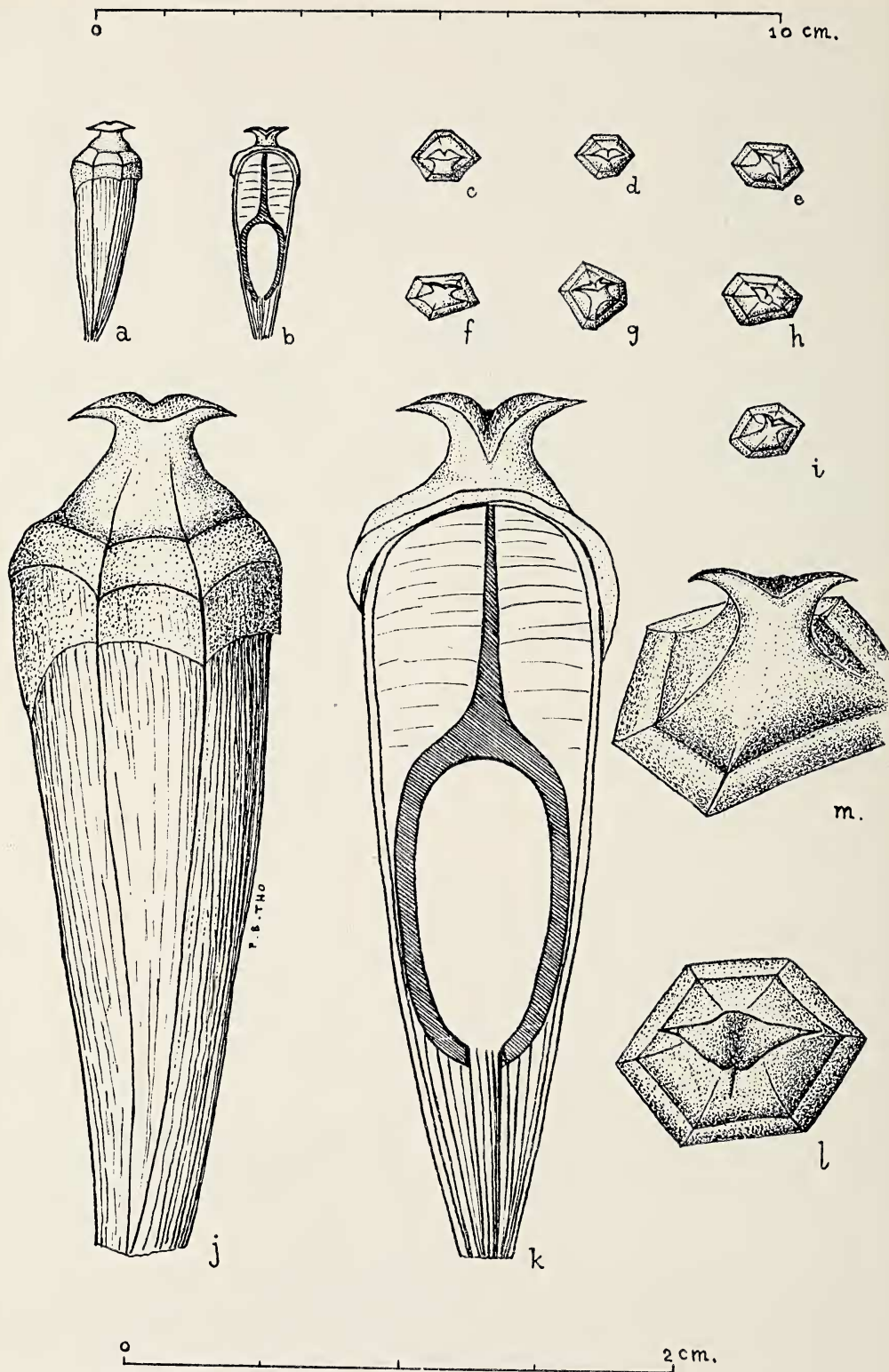
Figs. 212, 214b

DIAGNOSIS HOLOTYPI: Caulibus 1.5 m altis 4–5 cm diametro lucidis cum radicillis adpresse adscendentibus paucis, foliis 2.72 m longis 3.8 cm latis infra olivaceis supra obscure ita et profunde sulcatis 2-plicatis, in sectione mediali cum 33 nervis secundariis parallelis in quoque latere, proxima apicem nervis tertiis transversis evidenti et reticulis oblongis formantibus, lamina ligulata in apice 20 cm longo trigono subulato caudato abrupte contracta eo 10 cm ex apice 1 mm lato, basi amplexicauli inermi exlucida cupracea et ex 10–14 cm marginibus cum aculeis

2–4 mm longis 9–18 mm separatis crassiter subulatis rectis adscendentibus apicibus brunneis, midnervo infra ex 8 cm cum spinis 3–4 mm longis 17–35 mm separatis conicis reflexis brunneis, in sectione mediali marginibus cum aculeis 2–3 mm longis 15–25 mm separatis crassiter subulatis adpresse adscendentibus albis sed apicibus brunneis, midnervo infra cum spinis reflexis eis basalibus simulantibus sed 6–8 cm separatis, in sectione apicali diminuenti marginibus et midnervo infra cum serris 0.5–1 mm longis 1.5–5 mm separatis, in apice subulato marginibus cum serrulis 0.3–0.5 mm longis 1.5–3 mm separatis translucis sed apicibus brunneis, inflorescentia foeminea terminali cernua cum syncarpio unico, pedunculo 45 cm longo 1.8 cm diametro 3-laterato folioso-bracteato, bracteis interioribus 15 cm longis 4.4 cm latis lanceolatis marginibus et midnervo infra serratis, syncarpio 10.5 cm longo, 7.8 cm diametro latiter ellipsoideo cum circa 720 drupis, eis submaturis viridibus lutescentibus eis lateralibus 26–27 mm longis 6–9 mm latis 5–7 mm crassis anguste oblanceoloideis parte $\frac{1}{6}$ supera libera illis terminalibus et subterminalibus 30–31 mm longis 9–11 mm latis 7–10 mm crassis anguste oblanceoloideis 6-angulosis corpore 25–28 mm longo, pileo cum basi 5–6 mm alta rotundato-conica 6-angulosa laevi viridi subglauca, stylo druparum lateralium erecto solido bifurcato furcis lanceolatis acerosis in angulis rectis divergentibus, stigmatibus lanceolatis brunneis papillois terminalibus sed lobatis in stylis multis cum lobulis secundariis, basi 1–2 mm longa lobis principalibus 2.5–3.5 mm longis, endocarpio in parte $\frac{1}{3}$ infera brunneo ellipsoideo acuminato lateribus 0.1 mm crassis cartilagineis, semine 12 mm longo 2.5 mm diametro ellipsoideo, mesocarpio apicali medullosa humido sine fibris, mesocarpio basali 3 mm longo in lateribus fibrosis in centro carnosio.

DIAGNOSIS OF HOLOTYPE: Stem 1.5 m tall, 4–5 cm in diameter, shining, with a few appressed ascending rootlets; leaves 2.72 m long,

FIG. 210. *Pandanus cupribasalis* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, *d*, *f*, *b*, *i*, typical lateral drupes, apical view, $\times 1$; *e*, apex and stigma of apical drupe, proximal view, $\times 4$; *j*, apex and stigma of typical lateral drupe, proximal view, $\times 4$; *k*, apex and stigma of rare 3-fid lateral drupe, apical view, $\times 4$; *l*, leaf base, lower side, $\times 1$; *m*, leaf middle, lower side, $\times 1$; *n*, leaf apex, lower side, $\times 1$; *o*, veins, lower side, towards apex, $\times 4$.



3.8 cm wide nearly throughout, olive green below, darkly so above with a deep furrow over the midrib, 2-pleated, at midsection with 33 secondary parallel veins in each side, and near the tip tertiary cross veins visible, forming oblong meshes; blade ligulate, abruptly contracted to a 20 cm subulate, trigonous, caudate apex, this 10 cm down 1 mm wide, the base amplexicaul, unarmed, dull coppery, beginning at 10–14 cm the margins with prickles 2–4 mm long, 9–18 mm apart, heavy subulate, straight, ascending, brown-tipped; the midrib below beginning at 8 cm with thorns 3–4 mm long, 17–35 mm apart, conical, reflexed, brown; at midsection the margins with prickles 2–3 mm long, 15–25 mm apart, thick subulate, appressed ascending, white below, with a brown tip; the midrib below with reflexed spines like the basal ones but 6–8 cm apart; where the blade narrows the margins and midrib below with serrations 0.5–1 mm long, 1.5–5 mm apart; on the subulate apex the margins with serrulations 0.3–0.5 mm long, 1.5–3 mm apart, brown-tipped, but the rest clear and translucent; pistillate inflorescence terminal, cernuous, with a single syncarp; peduncle 45 cm long, 1.8 cm in diameter, 3-sided, leafy bracted; the inner bracts 15 cm long, 4.4 cm wide, lanceolate, serrate on margins and midrib below; syncarp 10.5 cm long, 7.8 cm in diameter, broadly ellipsoid, bearing about 720 drupes, these immature, green, but some turning yellowish, the lateral ones 26–27 mm long, 6–9 mm wide, 5–7 mm thick, narrowly oblanceoloid, upper $\frac{1}{6}$ free, the terminal and subterminal ones 30–31 mm long, 9–11 mm wide, 7–10 mm thick, narrowly oblanceoloid, 6-angled, the body 25–28 mm long; pileus with its base 5–6 mm high, rounded conic, 6-angled, smooth, green, slightly glaucous; style of lateral drupes erect, stout, bifurcate, the forks lanceolate, spreading horizontally, acerose tipped; stigmas lanceolate, brown, papillose, terminal, but on the many styles with 2–4 short proximal secondary lobes, running over them also, style base 1–2 mm

long, main lobes 2.5–3.5 long; endocarp in lower $\frac{1}{3}$, brown, ellipsoid, with an apical subulate extension to the style, the walls cartilaginous, 0.1 mm thick; seed 12 mm long, 2.5 mm in diameter, ellipsoid; apical mesocarp a moist pith, without fibers; basal mesocarp 3 mm long, fibrous up the periphery, fleshy within.

HOLOTYPE: Vietnam, île Hon Tho'm, s. of Ile Phu qu'óc, 7 avril 1961, *Pham Hoang Ho 2,519* (BISH).

DISCUSSION: *P. horizontalis* is a member of the section *Rykia*. It has the hornlike, bifurcate style of that section and on the terminal and subterminal drupes the style is bent proximally and the stigmas are proximal as is normal. On all the lateral drupes, which are very numerous, the style is erect, with its forks extending laterally at right angles, and the stigmas are terminal. This is exceptional, but from the fact that the style is hornlike, and bifurcate, and that some of them incline in the proximal direction, it is concluded that this new species really belongs in the section *Rykia*.

No close relative of this new species has been described. The closest is an undescribed species from Thailand, Chanturi, *Tem Smitinand 4,054*, but this has smaller, broader drupes, etc.

The new epithet is the Latin adjective *horizontalis*, horizontal, and is given in reference to the horizontal forks of the style and the stigmas.

LOCALITY RECORDS OF PANDANUS IN VIETNAM

Pandanus ceratostigma Martelli

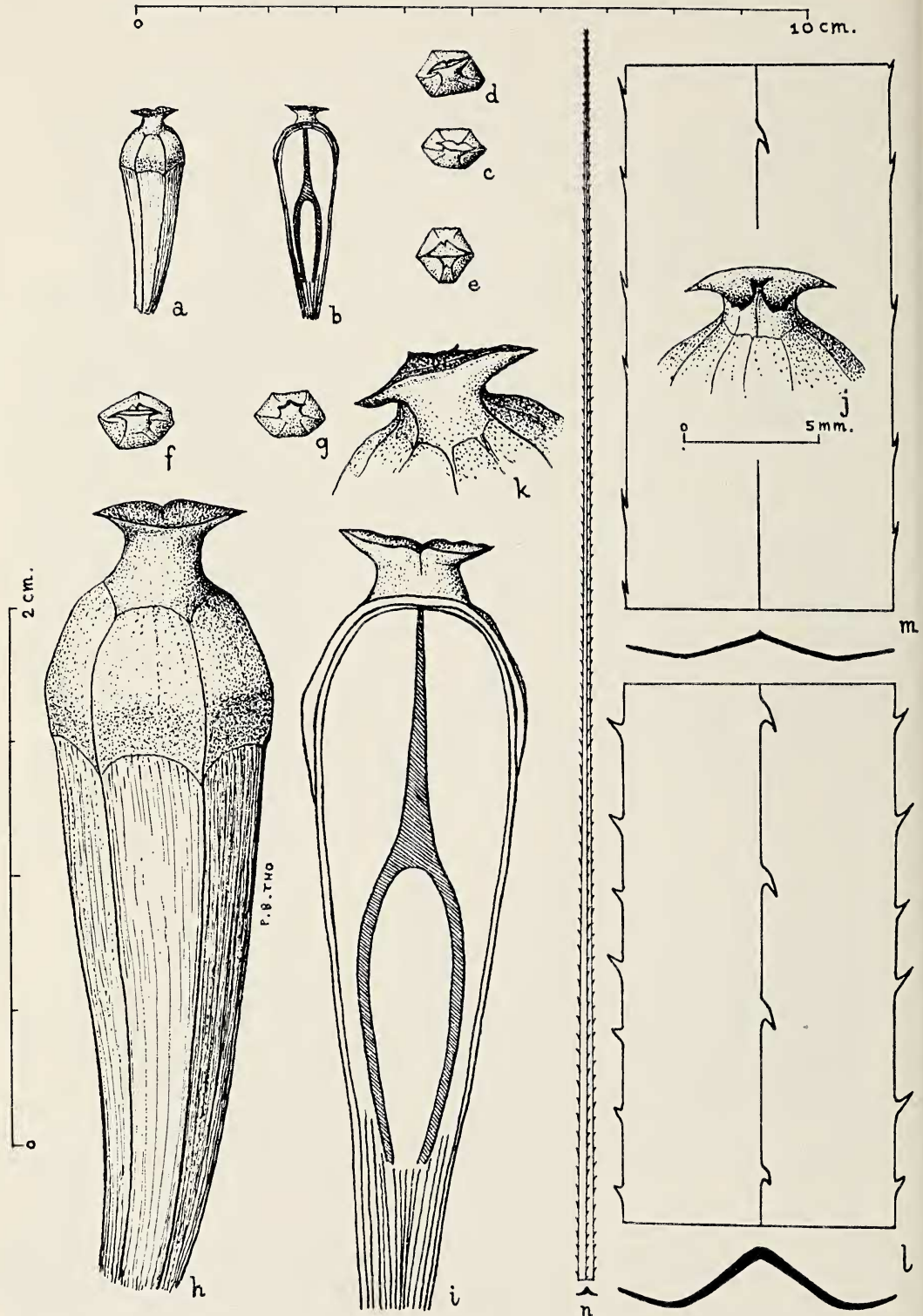
Region de Long câu, Col de Tuy lu'at, at km. 1,267, male, 6 fevrier 1961, *P. H. Ho 2,605* (BISH, UNIV. SAIGON). Also his no. 2,610.

Col de Dio Cà (Varella), près du poste militaire, km. 1,364, 6 fevrier 1961, *Pham Hoang Ho 2,604* (BISH, UNIV. SAIGON).

Pandanus integriapicis St. John

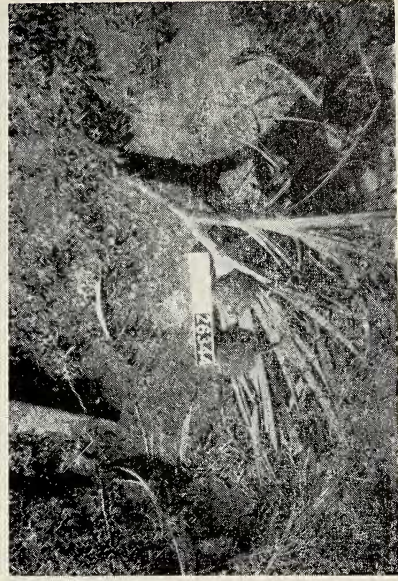
Prov. de Phu yê, Anthan (Tuyan), km.

FIG. 211. *Pandanus depressus* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, *d*, *e*, *f*, *g*, *h*, *i*, drupe, apical view, $\times 1$; *j*, drupe, lateral view, $\times 4$; *k*, drupe, longitudinal median section, $\times 4$; *l*, drupe apex and stigma, apical view, $\times 4$; *m*, drupe apex and stigma, oblique distal view, $\times 4$.





a



b



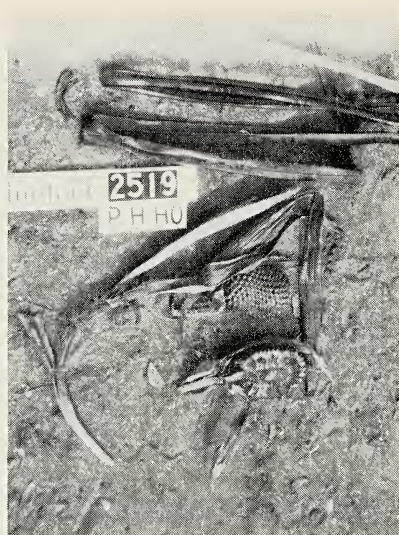
c



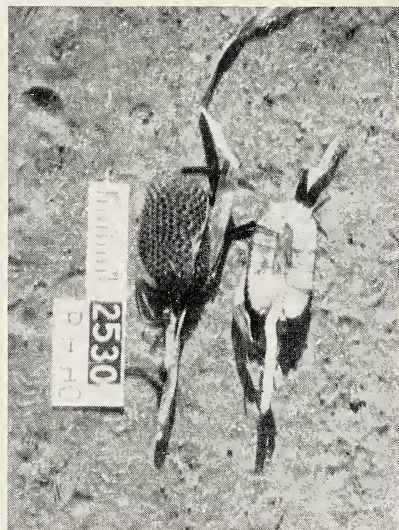
d

FIG. 213. a, *Pandanus pendens* St. John, holotype, habit; b, fruiting branch; c, *Pandanus cupribasalis* St. John, holotype, fruiting stalk; d, branch with syncarp.

FIG. 212. *Pandanus horizontalis* St. John, from holotype. a, Drupe, lateral view, $\times 1$; b, drupe, longitudinal median section, $\times 1$; c, d, e, f, g, drupe, apical view, $\times 1$; h, drupe, lateral view, $\times 4$; i, drupe, longitudinal median section, $\times 4$; j, drupe apex and stigma, proximal view, $\times 4$; k, drupe apex and stigma, distal view, $\times 4$; l, leaf base, lower side, $\times 1$; m, leaf middle, lower side, $\times 1$; n, leaf apex, lower side, $\times 1$.



a



b

FIG. 214. *a*, *Pandanus depressus* St. John, holotype, syncarp, lateral view, and longitudinal median section; *b*, *Pandanus horizontalis* St. John, holotype, leaf and syncarp, lateral view, and longitudinal median section.

1,291, 6 fevrier 1961, *Pham Hoang Ho* 2,608 (BISH, UNIV. SAIGON).

Pandanus Smitinandii St. John

Prov. de Phu yê, Anthan (Tuyen), km. 1,291, les haies, les bourgeons donnés aux cochons, 6 fevrier 1961, *Pham Hoang Ho* 1,291 (UNIV. SAIGON); km. 1,260, cultivé au bord du cours d'eau et en bordure du rivièrè, 6 fevrier

1961, *Pham Hoang Ho* 2,609 (BISH, UNIV. SAIGON).

Pandanus vietnamensis St. John

Nhatrang, 1.5 km. du gare, près du chemin de fer, à bifurcation pour aller à Ninhhoa, cultivé, 6 fevrier 1961, *Pham Hoang Ho* 2,611 (BISH, UNIV. SAIGON).